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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,867	01/22/2004	Matthew Conover	SYMC1044	8505
34350 7590 03/12/2007 GUNNISON, MCKAY & HODGSON, L.L.P. 1900 GARDEN ROAD, SUITE 220 MONTEREY, CA 93940			EXAMINER BAUM, RONALD	
			ART UNIT	PAPER NUMBER
			2136	
SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	Application No. 10/763,867	Applicant(s) CONOVER ET AL.	
	Examiner Ronald Baum	Art Unit 2136	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 January 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-22,24 and 26 is/are rejected.
- 7) ☒ Claim(s) 3,4,23 and 25 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>20070307</u> . | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. This action is in reply to applicant's correspondence of 22 January 2004.
2. Claims 1-26 are pending for examination.
3. Claims 1, 2, 5-22, 24 and 26 are rejected.

### *Claim Rejections - 35 USC § 101*

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

5. Claims 1, 2, 11, 15, 19-22, 24 and 26 are rejected under 35 U.S.C. 101 because the disclosed invention is inoperative and therefore lacks utility. The "determining whether said call ..." per se does not produce a tangible result. For the sake of applying art, the examiner assumes that the method determination aspects are subsequently embodied in a tangible result. Correction is required.

6. Claim 26 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The phrase "A computer program product comprising" is not necessarily embodied software on computer readable media (subject to inclusion of said subject matter in the specification) corresponding to a method of said embodied software. For the sake of applying art, the examiner assumes that the embodied software of the method is so embodied on computer readable media. Correction is required.

*Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 5-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Baratloo, A., et al, 'Transparent Run-Time Defense Against Stack Smashing Attacks', 2000 Proceedings of the USENIX Annual Technical Conference, entire document, <http://citeseer.ist.psu.edu/cache/papers/cs/24655/http:zSzzSzwww.research.avayalabs.comzSzprojectzSzlibsafezSzdoczSzusenix00.pdf/baratloo00transparent.pdf> ('Baratloo').

8. As per claim 1; "A method comprising:

stalling a call to

a critical operating system (OS) function [Sections 4-7 generally, and more particularly section 6, whereas the libverify 'return address verification scheme ...'

techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures, encompasses the claimed limitations as broadly interpreted by the examiner.]; and

determining whether branch trace records of said call include

a return instruction [Sections 3-7 generally, and more particularly sections 3, 6, 7 whereas the 'sand-boxing environment ...' and libverify 'return address verification scheme ...' techniques, of which OS debugging features trace and strace encompass storage (i.e., recording and subsequent logging) of call/ret (i.e., branch) events, and subsequent use of call/ret information in the process branching analysis/attack support

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functions, and, 'instrumentation code' with associated determination of location/address code characteristics as stored in a working (i.e., tracing) buffer/memory storage arrangement thereby, encompasses the claimed limitations as broadly interpreted by the examiner.].”.

9. Claim 5 *additionally recites* the limitation that; “The method of claim 1 further comprising

taking protective action to protect a computer system

upon a determination that

said branch trace records include

said return instruction.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-7 generally, and more particularly section 6, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the die () function is called/not called (and associated subsequent logging as a syslog entry either way), encompasses the claimed limitations as broadly interpreted by the examiner.).

10. Claim 6 *additionally recites* the limitation that; “The method of claim 5 wherein said taking protective action comprises

terminating said call.”.

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The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify 'return address verification scheme ...' techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way), encompasses the claimed limitations as broadly interpreted by the examiner.).

11. Claim 7 *additionally recites* the limitation that; "The method of claim 5 wherein said taking protective action comprises

terminating a call module originating said call."

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify 'return address verification scheme ...' techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way), encompasses the claimed limitations as broadly interpreted by the examiner.).

12. Claim 8 *additionally recites* the limitation that; "The method of claim 5 wherein said taking protective action comprises

) terminating a parent application comprising

a call module originating said call.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way), encompasses the claimed limitations as broadly interpreted by the examiner.).

13. Claim 9 *additionally recites* the limitation that; “The method of claim 5 further comprising

providing a notification that

said protective action has been taken.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way) such that attack scenarios both known and *previously unknown*, encompasses the claimed limitations as broadly interpreted by the examiner.).

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14. Claim 10 *additionally recites* the limitation that; “The method of claim 1 further comprising

allowing said call to proceed

upon a determination that

said branch trace records

do not include said return instruction.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-7 generally, and more particularly section 6, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the die () function is called/not called (and associated subsequent logging as a syslog entry either way), encompasses the claimed limitations as broadly interpreted by the examiner.).

15. Claim 11 *additionally recites* the limitation that; “ The method of claim 1 wherein upon a determination that

said branch trace records include

said return instruction,

said method further comprising

determining whether said call is

a known false positive.”.



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The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify 'return address verification scheme ...' techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way) such that attack scenarios both known and *previously unknown*, encompasses the claimed limitations as broadly interpreted by the examiner.).

16. Claim 12 *additionally recites* the limitation that; "The method of claim 11 wherein upon a determination that said call
- is not said known false positive,
- said method further comprising
- taking protective action to protect a computer system."

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify 'return address verification scheme ...' techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way) such that attack scenarios both known and *previously unknown*, encompasses the claimed limitations as broadly interpreted by the examiner.).

17. Claim 13 *additionally recites* the limitation that; “The method of claim 12 further comprising
- providing a notification that
- said protective action has been taken.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way) such that attack scenarios both known and *previously unknown*, encompasses the claimed limitations as broadly interpreted by the examiner.).

18. Claim 14 *additionally recites* the limitation that; “ The method of claim 11 wherein
- upon a determination that
- said call is said known false positive,
- said method further comprising
- allowing said call to proceed.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part

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of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way) such that attack scenarios both known and *previously unknown*, encompasses the claimed limitations as broadly interpreted by the examiner.).

19. Claim 15 *additionally recites* the limitation that; “The method of claim 1 further comprising

hooking said critical OS function.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-7 generally, and more particularly section 6, whereas the `libverify` ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., OS call stalling) interceptor called as part of the operating system kernel (i.e., hooking), and associated modification and retention of user code size, location, addressing structures, encompasses the claimed limitations as broadly interpreted by the examiner.).

20. Claim 16 *additionally recites* the limitation that; “The method of claim 1 further comprising

recording said branch trace records.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 3-7 generally, and more particularly sections 3, 6, 7 whereas the ‘sand-boxing environment ...’ and `libverify` ‘return address verification scheme ...’ techniques, of which OS debugging features `trace` and

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strace encompass storage (i.e., recording and subsequent logging) of call/ret (i.e., branch) events, and subsequent use of call/ret information in the process branching analysis/attack support functions, and, 'instrumentation code' with associated determination of location/address code characteristics as stored in a working (i.e., tracing) buffer/memory storage arrangement thereby, encompasses the claimed limitations as broadly interpreted by the examiner.).

21. Claim 17 *additionally recites* the limitation that; "The method of claim 16 further comprising

suspending recording of said branch trace records

prior to said determining whether

branch trace records of said call include

a return instruction.".

The teachings of Baratloo are directed towards such limitations (i.e., Sections 3-7 generally, and more particularly sections 3, 6, 7 whereas the 'sand-boxing environment ...' and libverify 'return address verification scheme ...' techniques, of which OS debugging features trace and strace encompass storage (i.e., recording and subsequent logging) of call/ret (i.e., branch) events, and subsequent use of call/ret information in the process branching analysis/attack support functions, and, 'instrumentation code' with associated determination of location/address code characteristics as stored in a working (i.e., tracing) buffer/memory storage arrangement thereby, encompasses the claimed limitations as broadly interpreted by the examiner.).

22. Claim 18 *additionally recites* the limitation that; “The method of claim 17 further comprising

unsuspending recording of said branch trace records

after said determining whether

branch trace records of said call include

a return instruction.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 3-7 generally, and more particularly sections 3, 6, 7 whereas the ‘sand-boxing environment ...’ and libverify ‘return address verification scheme ...’ techniques, of which OS debugging features trace and strace encompass storage (i.e., recording and subsequent logging) of call/ret (i.e., branch) events, and subsequent use of call/ret information in the process branching analysis/attack support functions, and, ‘instrumentation code’ with associated determination of location/address code characteristics as stored in a working (i.e., tracing) buffer/memory storage arrangement thereby, encompasses the claimed limitations as broadly interpreted by the examiner.).

23. Claim 19 *additionally recites* the limitation that; “The method of claim 1 wherein said critical OS function is necessary for

a first application to cause

execution of a second application.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., critical OS call and associated chained

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sequences of calling via appropriate call parameter passing stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way) such that attack scenarios both known and *previously unknown*, encompasses the claimed limitations as broadly interpreted by the examiner.).

24. Claim 20 *additionally recites* the limitation that; “The method of claim 19 wherein said second application allows

remote access of a computer system.”.

The teachings of Baratloo are directed towards such limitations (i.e., Sections 4-8 generally, and more particularly sections 6-8, whereas the libverify ‘return address verification scheme ...’ techniques with the associated system call/return (i.e., critical OS call and associated chained sequences of calling via appropriate call parameter passing, both locally and networked objects access stalling) interceptor called as part of the operating system kernel, and associated modification and retention of user code size, location, addressing structures such that upon determination of an attack/non-attack scenario, the `die()` function is called/not called (and associated subsequent logging as a `syslog` entry either way) such that attack scenarios both known and *previously unknown*, encompasses the claimed limitations as broadly interpreted by the examiner.).

*Allowable Subject Matter*

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25. Claims 2-4 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, and, subject to the above 35 U.S.C. 101 rejection considerations..

26. Claim 2 *additionally recites* the limitation that; “The method of claim 1 wherein said determining whether branch trace records of said call include a return instruction comprises:

locating

a most recent branch trace record of

said branch trace records;

searching said branch trace records from said most recent branch trace record

to locate

a user to kernel branch trace record of

said branch trace records; and

searching previous branch trace record

previous to said user to kernel branch trace record for

said return instruction.”

27. Claim 3 *additionally recites* the limitation that; “The method of claim 2 wherein upon a determination that

said previous branch trace records

do not include said return instruction,

said method further comprising  
allowing said call to proceed.”

28. Claim 4 *additionally recites* the limitation that; “The method of claim 2 wherein  
upon a determination that

at least one of said previous branch trace records  
does include said return instruction,  
said method further comprising  
taking protective action to protect a computer system.”

29. Claims 21-26 are allowed over prior art.

30. As per claim 21; “A method comprising:  
recording  
branch trace records;  
stalling a call to  
a critical operating system (OS) function;  
suspending recording of  
said branch trace records;  
locating  
a most recent branch trace record of



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said branch trace records;  
searching  
said branch trace records from said most recent branch trace record  
to locate  
a user to kernel branch trace record of  
said branch trace records; and  
determining whether previous branch trace records  
previous to said user to kernel branch trace record include  
only call, jump, or interrupt instructions.”.

31. Claim 22 *additionally recites* the limitation that; “The method of claim 21 wherein  
said determining whether previous branch trace records  
previous to said user to kernel branch trace record include  
only call, jump, or interrupt instructions  
is performed until  
a determination is made that  
a last branch trace record has been reached.”

32. Claim 23 *additionally recites* the limitation that; “The method of claim 22 wherein  
upon a determination that  
said last branch trace record has been reached,  
said method further comprising

allowing said call to proceed.”

33. Claim 24 *additionally recites* the limitation that; “The method of claim 21 wherein said determining whether previous branch trace records

previous to said user to kernel branch trace record include

only call, jump, or interrupt instructions

is performed until

a determination is made that

at least one of said previous branch trace records includes

a return instruction.”

34. Claim 25 *additionally recites* the limitation that; “The method of claim 24 wherein upon a determination that

said at least one of said previous branch trace records includes

said return instruction,

said method further comprising

taking protective action to protect a computer system.”

35. Claim 26 *additionally recites* the limitation that; “A computer program product comprising:

a Return-to-LIBC attack detection application for

recording branch trace records;

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said Return-to-LIBC attack detection application further  
for stalling a call to  
a critical operating system (OS) function;  
said Return-to-LIBC attack detection application further  
for suspending recording of  
said branch trace records;  
said Return-to-LIBC attack detection application further  
for locating  
a most recent branch trace record of  
said branch trace records;  
said Return-to-LIBC attack detection application further  
for searching said branch trace records from  
said most recent branch trace record  
to locate  
a user to kernel branch trace record of  
said branch trace records; and  
said Return-to-LIBC attack detection application further  
for determining whether previous branch trace records  
previous to said user to kernel branch trace record include  
only call, jump, or interrupt instructions.”

***Conclusion***


36. Any inquiry concerning this communication or earlier communications from examiner should be directed to Ronald Baum, whose telephone number is (571) 272-3861, and whose unofficial Fax number is (571) 273-3861 and unofficial email is Ronald.baum@uspto.gov. The examiner can normally be reached Monday through Thursday from 8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nasser Moazzami, can be reached at (571) 272-4195. The Fax number for the organization where this application is assigned is **571-273-8300**.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. For more information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ronald Baum

NASSER MOAZZAMI  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2100

  
3,8107

Patent Examiner

